INVESTIGATOR'S ANNUAL REPORT

National Park Service

All or some of the information provided may be available to the public

Reporting Year: 1996	**Park:** Shenandoah NP
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No co-investigators

Permit#:
SHEN1996ARVV

Park-assigned Study Id. #:
unknown

Project Title:
Stream-Groundwater Interaction In A Saprolite Aquifer (N-162A)

Permit Start Date: Jan 01, 1996	**Permit Expiration Date** Jan 01, 1998
Study Start Date: Jan 01, 1996	**Study End Date** Jan 01, 1996

Study Status:
Completed

Activity Type:
Research

Subject/Discipline:
Water / Hydrology

Objectives:

The dynamic relationships between precipitation, groundwater flow in the saturated and unsaturated zones, and streamflow remain poorly understood, despite some major advances in the past decade in our understanding of individual facets of interaction. All of these processes occur simultaneously, yet few studies to date have combined surface water observations (discharge, hydrograph separations, transient storage of water and solutes within the hyporheic zone) with groundwater observations (composition, water table variations). The objectives of the study are:;> to conduct in-stream tracer tests using both conservative and non-conservative tracers within differing reaches;;> to quantify the dynamics of stream-groundwater interaction through numerical modeling of experimental tracer data;;> to examine water-table response within a saprolitic hillslope to precipitation events and use conservative chemical tracers (Cl-, 18/16O, and H/D) to separate storm hydrographs into "new" and "old" water components; and;> to develop SUTRA simulations of the hydrograph and chemograph data from several storm events, and compare these simulations with observed stream discharge and chemistry.;Once these objectives are met, the combination of surface and subsurface hydrologic data gathering and numerical simulation will increase our current understanding of water movement through catchments dominated by thick weathering profiles.

Findings and Status:

Tracer experiments have been conducted using both conservative and sorbing tracers, at both an upstream site and in the lower channel network. More work is necessary to continue analyzing samples and consider the behavior of the sorbing tracer. However, preliminary results show the nature of the breakthrough curves obtained from these experiments. The results and the modeling exercise have indicated a number of features of stream-groundwater interaction:;> Greater dilution due to lateral inflow, as evidenced by a reduction in peak concentration, occurs in the southernmost segment of the lower channel network. It should be mentioned that these tests were performed when the stream was approximately at baseflow conditions. The northern stream channels experienced little or no dilution due to lateral inflow.;> The exchange coefficients for all sites in the lower channel network were approximately 10-3 s-1, with relatively little variation, which indicates that exchange is relatively rapid (time constants of 1000 s or 15 minutes). This result is similar to that obtained for gravel mountain streams in the western U.S.;> Storage areas vary between 4 and 17 m2 for sites in the lower channel network, with the largest areas occurring in the southernmost stream channel (which also experienced the greatest dilution).;The differences between the northern and southern channels within the lower channel network can be explained as resulting from differences in surrounding geomorphology, stream

morphology, and stream bed slope. The southern channel is bordered by steep hillslopes, promoting lateral inflow, and is characterized by relatively slow velocities and gentle bed slopes. The northern channels have steeper bed slopes and more rapid flow. Thus, the northern channels have smaller storage zones than the southern channel.;As of the begining of 1997, the in-stream tracer tests have been completed. The next phase of the project will be to analyze stream hydrographs and chemographs from several storm events from the fall of 1996, and conduct numerical simulations of stream discharge and chemistry.

For this study, were one or more specimens collected and removed from the park but not destroyed during analyses?

No

Funding provided this reporting year by NPS:	**Funding provided this reporting year by other sources:**
0	0

Fill out the following ONLY IF the National Park Service supported this project in this reporting year by providing money to a university or college

Full name of college or university:	**Annual funding provided by NPS to university or college this reporting year:**
n/a	0